

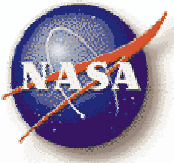
**Aviation Safety Program
System-Wide Accident Prevention**
FY 2001 Human Error Modeling Workshop
Program Product: SvS
October 18, 2001



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Synthetic Vision Systems



Project Goal:

Develop Technologies With Practical Applications That Eliminate Low Visibility Conditions As A Causal Factor To Civil Aircraft Accidents

>Objectives:

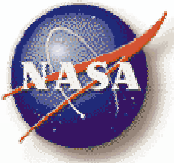
Develop & Demonstrate Affordable, Certifiable Display Configurations (Including Retrofit) To Provide Intuitive Out-The-Window Terrain & Obstacle Information, Including Guidance:

Synthetic Vision System: A database derived system which utilizes precise GPS navigation & integrity-monitoring sensors (as required) to provide a unrestricted synthetic view of the aircraft's current external environment.

SVS Characteristics:

- Provides intuitive perspective view
 - > Conformality (FOV) may be selectable
- Sufficient for tactical guidance of aircraft
 - > Must meet flight-critical system requirements
 - > Containing all PFD or HUD functionality (transport category)
- Driven by Internal database & GPS position
 - > Aerodrome, terrain & obstacle database requirements vary between vehicle classes
- Integrated integrity-monitoring sensors as required
 - > Must detect/display both cooperative & uncooperative traffic around the runway environment
 - > Sensor augmentation requirements vary between vehicle classes

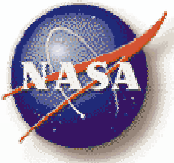




DFW Flight Test



- Dallas-Ft. Worth (DFW) Flight Test:
 - Sept-Oct 2000
 - 6 Evaluation Pilots
 - Objectives:
 - > Evaluate NASA Concepts:
 - € Retrofit Display Issues
 - € SV Display Concepts
 - > Evaluate Rockwell-Collins Head-Down Concept
 - € Targeted Near-Term Implementation Issues
 - > RIPS
 - € e.g., deceleration guidance to hold short

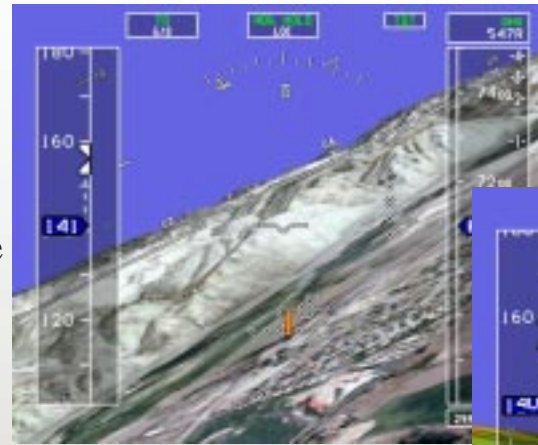


DFW Flight Test

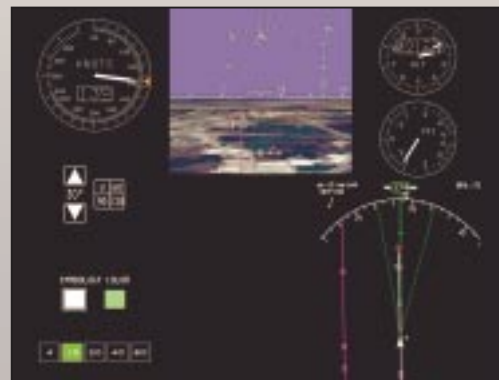
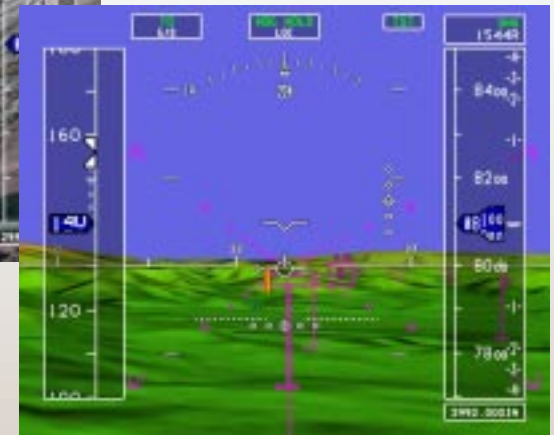


- Head-Down Display Concepts
 - Size: A/B, D, X
 - Terrain Database Texture:
 - Generic
 - Photo-realistic
 - Selectable Field of View (FOV)
 - > All Pilots Preferred Using Selectable FOVs
 - € Larger FOVs Prior to Final (~60 degrees)
 - € ~25-45 deg FOV For Runway Change
 - € Smaller FOVs Close-in on Final Approach (~30 Deg or Less, *Approaching Unity Magnification*)

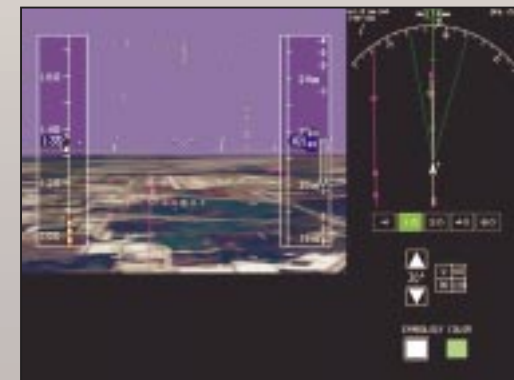
Photo-Realistic



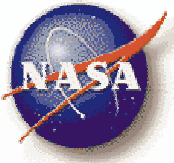
Generic



Size A/B



Size-X



DFW Flight Test



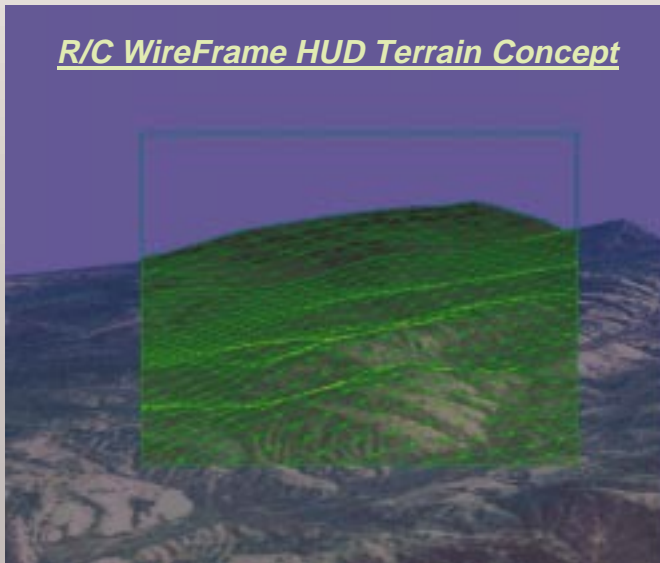
NASA Photo-Realistic HUD Concept

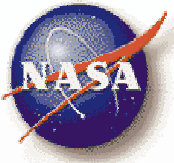


Stroke- on- Raster HUD

- *Unconventional* HUD Concept
 - *Opaque*, Computer-generated Terrain Scene With Symbology Overlay
 - > Clear, See-Thru Sky
 - > Declutter Switch Available to Remove Terrain Scene
 - > Certification Issues Identified
- Evaluated Two Terrain Texturing Techniques
 - Generic
 - Photo-Realistic

R/C WireFrame HUD Terrain Concept





Eagle/Vail Flight Test



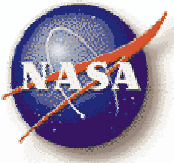
- Overall Objective:
 - Evaluate Safety and Performance Benefits of SVS Display Concepts For Terrain-Challenged Airport Operations
- 3 Week EGE Deployment With ARIES
 - 45 Research Flight Hours Planned
 - Using Existing Approach Procedures
 - Simulated Instrument Meteorological Conditions

Runway 25



Runway 7





Eagle/Vail Flight Test



- Display Device:
 - Head-Up Display (HUD)
 - Head-Down Display (HDD)
 - HDD Size & Field-of-View
 - Size A/B, D, X
 - Terrain Depiction
 - Generic
 - Photo-Texturing
 - Display Content Issues: PFD & HUD
 - Field-of-View Vs. Display Size
 - Terrain Scene Information
 - Symbolology
- Resolution of Display Size, Field-of-View and Terrain Database Requirements
 - Strategic SVS Concept Definition
 - “Compellingness” Evaluation
 - >Effect of Cognitive Capture and Task Workload on Synthetic Vision System (SVS) Display Approach Performance
 - €SVS With & Without Tunnel, Conventional PFD
 - Certification Issues
- Tactical SVS Concepts To Be Integrated With:
 - Strategic (Navigation) Displays
 - >Terrain Awareness and Warning Systems (TAWS)
 - Enhanced Vision Sensors
 - >EVS Presentation Within Tactical SVS Displays
 - Surface Operations Display Concepts
 - >Runway Incursion Prevention Systems (RIPS)

